GRADE 12
DIPLOMA EXAMINATION

Chemistry 30

January 1990

Alberta
EDUCATION

GRADE 12 DIPLOMA EXAMINATION
CHEMISTRY 30

DESCRIPTION

Time: 2½ hours

Total possible marks: 70

This is a **closed-book** examination consisting of **three** parts:

PART A has 49 multiple-choice questions each with a value of one mark.

PART B has seven machine-scorable open-ended questions each with a value of one mark.

PART C has three written-response questions for a total of 14 marks.

A chemistry data booklet is provided for your reference.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

GENERAL INSTRUCTIONS

Fill in the information required on the answer sheet and the examination booklet as directed by the examiner.

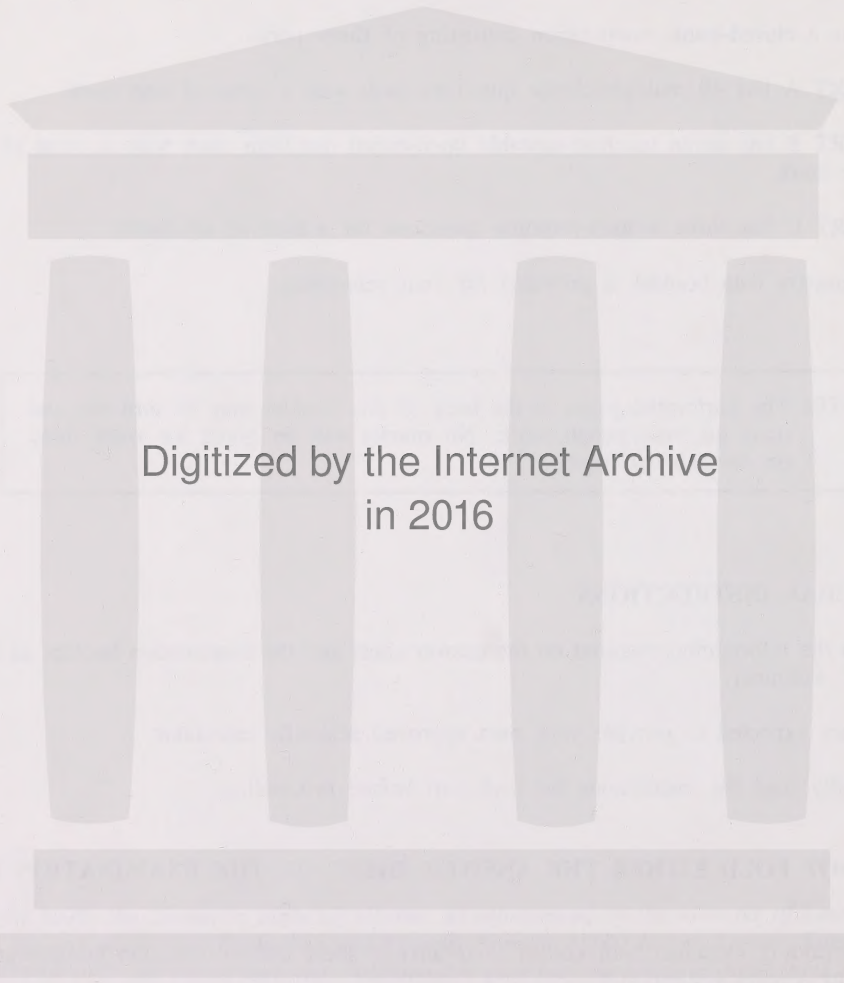You are expected to provide your own approved scientific calculator.

Carefully read the instructions for each part before proceeding.

DO NOT FOLD EITHER THE ANSWER SHEET OR THE EXAMINATION BOOKLET.

The presiding examiner will collect your answer sheet and examination booklet and send them to Alberta Education.

JANUARY 1990

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PART A

INSTRUCTIONS

In this part of the examination, there are 49 multiple-choice questions each with a value of one mark. All numbers used in the questions are to be considered as the result of a measurement.

Read each question carefully and decide which of the choices **best** completes the statement or answers the question. Locate that question number on the separate answer sheet provided and fill in the space that corresponds to your choice. **Use an HB pencil only.**

Example	**Answer Sheet**
This diploma examination is for the subject area of	A B C D

A. Biology
B. Physics
C. Chemistry
D. Mathematics

If you wish to change an answer, erase your first mark completely.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

DO NOT TURN THE PAGE TO START THE EXAMINATION UNTIL TOLD TO DO SO BY THE PRESIDING EXAMINER.

1. If during an energy change, the heat content of the products is different from that of the reactants but no new substance is formed, the change is most likely a
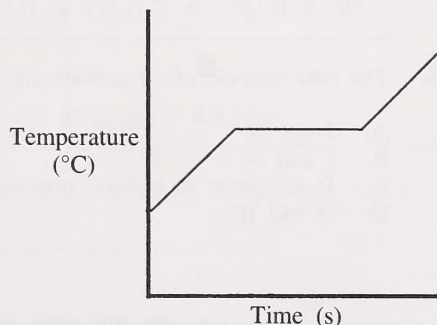
   A. chemical change or a phase change
   B. nuclear change or a chemical change
   C. phase change or a temperature change
   D. nuclear change or a temperature change

2. Water at 25.0°C is heated and vaporizes to steam at 150.0°C. Which diagram illustrates the enthalpy changes that occur?

   A.

   Temperature (°C)

   Time (s)

   B.

   Temperature (°C)

   Time (s)

   C.

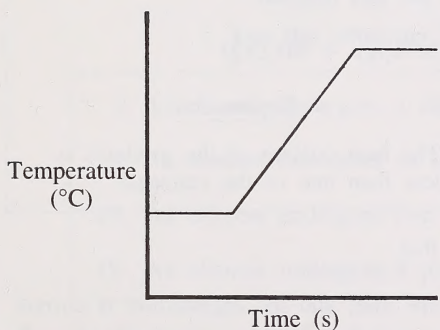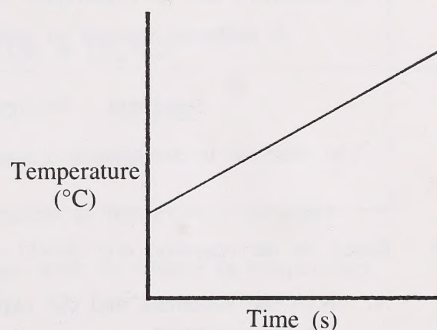   Temperature (°C)

   Time (s)

   D.

   Temperature (°C)

   Time (s)
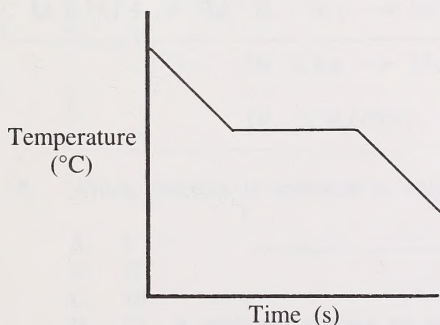
3. 0.250 mol of element X is burned in oxygen to produce 0.250 mol of the corresponding oxide. The temperature of 200.0 g of the surrounding water rises 15.0°C. The molar heat of formation for the compound is

   A. − 1.26 kJ/mol
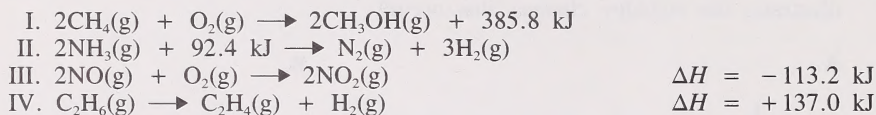   B. − 3.15 kJ/mol
   C. − 12.6 kJ/mol
   D. − 50.3 kJ/mol

4. Which of these compounds is the most stable?

    A. $H_2O(l)$
    B. $NO_2(g)$
    C. $C_2H_4(g)$
    D. $Al_2O_3(s)$

> I. $2CH_4(g) + O_2(g) \longrightarrow 2CH_3OH(g) + 385.8$ kJ
> II. $2NH_3(g) + 92.4$ kJ $\longrightarrow N_2(g) + 3H_2(g)$
> III. $2NO(g) + O_2(g) \longrightarrow 2NO_2(g)$ $\Delta H = -113.2$ kJ
> IV. $C_2H_6(g) \longrightarrow C_2H_4(g) + H_2(g)$ $\Delta H = +137.0$ kJ

5. The two endothermic reactions are

    A. I and II
    B. I and IV
    C. II and IV
    D. II and III

> A statement and an explanation are given for this reaction:
>
> $$C_5H_{12}(l) + 8O_2(g) \longrightarrow 5CO_2(g) + 6H_2O(g)$$
>
> | Statement | Explanation |
> |---|---|
> | The reaction is exothermic. | The heat content of the products is less than that of the reactants. |
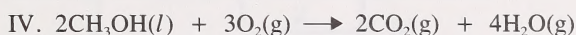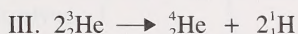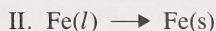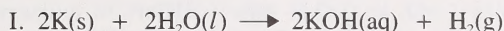
6. Based on the reaction, one should conclude that

    A. both the statement and the explanation are true, and the explanation is correct for the statement

    B. both the statement and the explanation are true, but the explanation is not correct for the statement

    C. the statement is true, but the explanation is false

    D. the statement is false, but the explanation is true

7. The best interpretation that a student can make when a liquid turns to vapor at its boiling point is that the

A. potential energy of the molecules increases
B. bonds within the molecules are rearranged
C. kinetic energy of the molecules decreases
D. temperature of the system rises

Use the following information to answer question 8.

$$I.\ 2K(s)\ +\ 2H_2O(l)\ \longrightarrow\ 2KOH(aq)\ +\ H_2(g)$$

$$II.\ Fe(l)\ \longrightarrow\ Fe(s)$$

$$III.\ 2{}^{3}_{2}He\ \longrightarrow\ {}^{4}_{2}He\ +\ 2{}^{1}_{1}H$$

$$IV.\ 2CH_3OH(l)\ +\ 3O_2(g)\ \longrightarrow\ 2CO_2(g)\ +\ 4H_2O(g)$$

8. Which reaction is expected to release the greatest amount of energy?

A. I
B. II
C. III
D. IV

Use the following information to answer question 9.

I. An element undergoes a chemical reaction.

II. An element undergoes an atomic number change.

III. An element undergoes two phase changes as temperature increases.

IV. An element undergoes a phase change with no change in temperature.

9. An observer can predict that

A. I, II, and III are examples of exothermic reactions
B. high energy change is associated with statement II
C. there is no energy change associated with statement IV
D. the relative order of energy change from highest to lowest is I, II, III, IV

10. For the reaction $CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$, predict the mass of $CaO(s)$ produced when 712 kJ of energy are absorbed.

   A.   4.00 g
   B.   17.8 g
   C.   62.8 g
   D.   224 g

Use the following diagram to answer question 11.
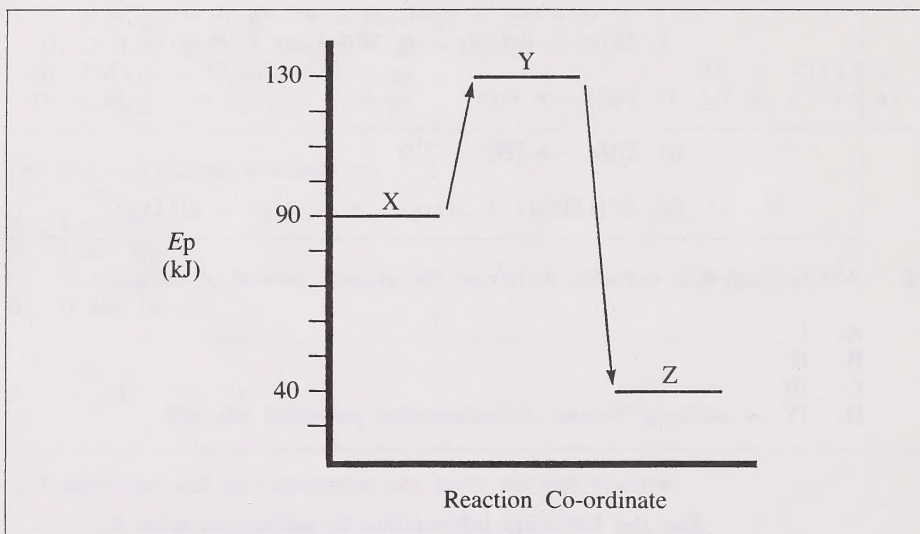
11. The ΔH for the reaction X $\longrightarrow$ Z is

   A.   + 130 kJ
   B.   + 40 kJ
   C.   − 50 kJ
   D.   − 90 kJ

   _____

12. During the production of a small amount of material, there is a large decrease in the temperature of the water in the calorimeter. The ΔH for the reaction should be

   A.   large and positive
   B.   small and positive
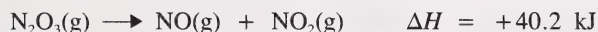   C.   small and negative
   D.   large and negative

A student carried out this experiment:

- recorded the temperature of the water
- obtained 2.5 g of NaOH(s) pellets
- added the pellets to the water and stirred them until they dissolved
- observed an increase in the temperature of the water

13. Which statement could be proven using **only** the procedure outlined?

A. The heat of reaction of NaOH(s) with $H_2O(l)$ is 426.7 kJ/mol.
B. The solubility of NaOH(s) is affected by Δt of the water.
C. An exothermic reaction will occur when NaOH(s) is added to $H_2O(l)$.
D. Δt of the water will vary with an increase in the amount of NaOH(s) dissolved.

$$N_2O_3(g) \longrightarrow NO(g) + NO_2(g) \qquad \Delta H = +40.2 \text{ kJ}$$

$$2NO_2(g) \longrightarrow N_2O_4(g) \qquad \Delta H = -23.4 \text{ kJ}$$

14. For the reaction $2NO(g) + N_2O_4(g) \longrightarrow 2N_2O_3(g)$, the ΔH is

A. -63.6 kJ
B. -57.0 kJ
C. -33.6 kJ
D. $+16.8$ kJ

In an experiment, the same amount of heat was added to various masses of water having the same initial temperature. The final water temperatures were recorded.

15. If data from this experiment are plotted on a graph, which variable will be the dependent (responding) variable?

A. Mass of water
B. Final temperature
C. Initial temperature
D. Amount of heat

16. For the change $CS_2(g) \longrightarrow CS_2(l)$, $\Delta H = -27.44$ kJ. The heat released when 15.2 g of gaseous carbon disulphide are converted to the liquid state is

A. 417 kJ
B. 27.4 kJ
C. 5.48 kJ
D. 2.74 kJ

17. A solution conducts electricity well. It has no effect on red or blue litmus and does **not** react with magnesium metal. The solution could be

A. $HCl(aq)$
B. $NaOH(aq)$
C. $NaCl(aq)$
D. $C_2H_5OH(aq)$

Use the following information to answer question 18.

A student checked four solutions for conductivity and indicator properties, and tabulated the results:

Solution	Conductivity	Bromothymol Blue
I	high	yellow
II	high	green
III	low	green
IV	high	blue

18. The solution most likely to be $KNO_3(aq)$ is

A. I
B. II
C. III
D. IV

19. Which of the following represents a neutralization reaction?

A. $H_2SO_4(aq) \longrightarrow H^+(aq) + HSO_4^-(aq)$

B. $C_5H_{12}(l) + 8O_2(g) \longrightarrow 5CO_2(g) + 6H_2O(g)$

C. $NH_4OH(aq) + HClO_3(aq) \longrightarrow NH_4ClO_3(aq) + H_2O(l)$

D. $3BaCl_2(aq) + Al_2(SO_4)_3(aq) \longrightarrow 2AlCl_3(aq) + 3BaSO_4(s)$

20. When compared with a weak acid, a stronger acid may be conceptually defined as one that

    A. dissociates more in water to produce hydronium ions
    B. conducts an electric current less readily
    C. neutralizes bases more effectively
    D. produces a more soluble salt

21. Two hypothetical ions, $Z^+(aq)$ and $Q^-(aq)$, form compounds $ZOH(aq)$ and $HQ(aq)$ by combining with hydroxide and hydrogen ions respectively. The Arrhenius base in the reaction between these compounds will be

    A. $ZQ(aq)$
    B. $ZOH(aq)$
    C. $QOH(aq)$
    D. $HQ(aq)$

22. A polyprotic acid is

    A. $HCOOH(aq)$
    B. $CH_3COOH(aq)$
    C. $HOOCCOOH(aq)$
    D. $C_6H_5COOH(aq)$

23. Which may act as both a Brønsted-Lowry acid and a Brønsted-Lowry base?

    A. $NH_4^+(aq)$

    B. $HNO_2(aq)$

    C. $SO_3^{2-}(aq)$

    D. $HS^-(aq)$

24. Which concentration of $HCl(aq)$ would yield the same pH as 0.10 mol/L $CH_3COOH(aq)$?

    A. 1.3 mol/L
    B. 1.0×10^{-1} mol/L
    C. 1.3×10^{-2} mol/L
    D. 1.3×10^{-3} mol/L

25. A student determines that 0.001 mol/L HCN(aq) has a pH of approximately 6. The student should describe this solution as

A. dilute and weakly acidic
B. dilute and strongly acidic
C. concentrated and weakly acidic
D. unable to be determined

26. As a solution becomes more acidic, the

A. $[H_3O^+(aq)]$ decreases and the pH increases
B. $[H_3O^+(aq)]$ decreases and the pH decreases
C. $[OH^-(aq)]$ decreases and the pH increases
D. $[OH^-(aq)]$ decreases and the pH decreases

27. What is the $[OH^-(aq)]$ of a solution that has a pH of 5.70?

A. 2.0×10^{-10} mol/L
B. 5.0×10^{-9} mol/L
C. 2.0×10^{-6} mol/L
D. 5.0×10^{-5} mol/L

28. A solution has a pH of 6.5 and contains a few drops of phenolphthalein, methyl red, and thymol blue. The solution appears

A. green
B. yellow
C. orange
D. colorless

29. Phenolphthalein is put into a solution containing 0.20 mol of HCl(aq). If 0.18 mol of NaOH(aq) is then added, the solution should be predicted to be

A. colorless and acidic
B. colorless and basic
C. pink and acidic
D. pink and basic

30. Solutions of methanoic acid and sodium ethanoate are mixed. The net ionic equation that best describes the resulting reaction is

A. $H_3O^+(aq) + OH^-(aq) \leftrightharpoons H_2O(l) + H_2O(l)$

B. $H_3O^+(aq) + CH_3COO^-(aq) \leftrightharpoons CH_3COOH(aq) + H_2O(aq)$

C. $HCOOH(aq) + CH_3COO^-(aq) \leftrightharpoons CH_3COOH(aq) + HCOO^-(aq)$

D. $HCOOH(aq) + NaCH_3COO(aq) \leftrightharpoons CH_3COOH(aq) + NaHCOO(aq)$

31. The reaction in which products are favored is

A. $2HSO_4^-(aq) \leftrightharpoons H_2SO_4(aq) + SO_4^{2-}(aq)$

B. $HF(aq) + SO_4^{2-}(aq) \leftrightharpoons HSO_4^-(aq) + F^-(aq)$

C. $H_3BO_3(aq) + OCl^-(aq) \leftrightharpoons H_2BO_3^-(aq) + HOCl(aq)$

D. $HCO_3^-(aq) + PO_4^{3-}(aq) \leftrightharpoons CO_3^{2-}(aq) + HPO_4^{2-}(aq)$

Use the following information to answer question 32.

A chemist performed a titration experiment and found that the volume of acid used from the burette was lower than the calculated theoretical volume needed to neutralize the base. Some of the suggested experimental errors were:

  I. Too much base was pipetted into the flask.
  II. The endpoint was passed.
  III. The wrong indicators were chosen.
  IV. There was water in the burette when the acid was added.
  V. There was water in the flask when the base was pipetted into it.

32. Which of the suggested experimental errors would account for the low volume of acid used?

A. III only
B. II, III, and IV only
C. I, III, IV, and V only
D. I, II, III, IV, and V

Use the following information to answer question 33.

The concentration of an acid, HA, was determined by titrating 25.0 mL with a solution of 0.050 mol/L potassium hydroxide.

The variation of pH with volume of potassium hydroxide is shown in the graph.
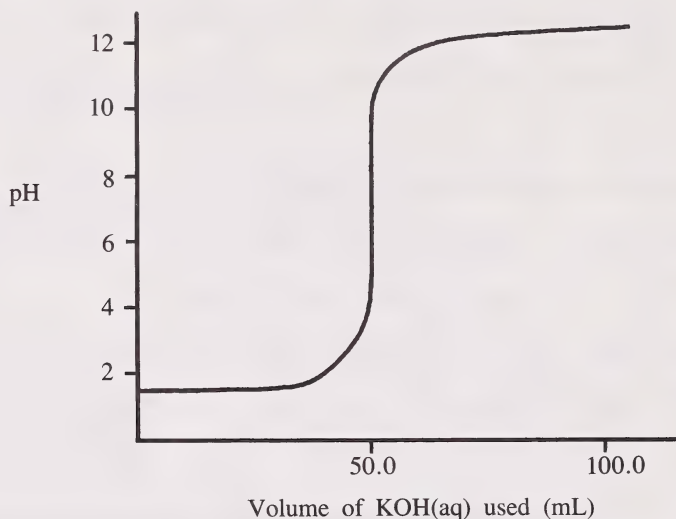
33. The concentration of the acid, HA, is

A. 0.10 mol/L
B. 0.050 mol/L
C. 0.025 mol/L
D. 0.010 mol/L
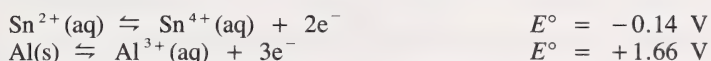
Use the following information to answer question 34.

$$Cr^{3+}(aq) + Al(s) \longrightarrow Cr(s) + Al^{3+}(aq)$$

34. The species that is reduced is

A. Al(s)
B. Cr(s)
C. $Al^{3+}(aq)$
D. $Cr^{3+}(aq)$

- 10 -

These half-reactions are used to make an electrochemical cell:

$$Sn^{2+}(aq) \leftrightharpoons Sn^{4+}(aq) + 2e^- \qquad\qquad E° = -0.14 \text{ V}$$
$$Al(s) \leftrightharpoons Al^{3+}(aq) + 3e^- \qquad\qquad E° = +1.66 \text{ V}$$

35. Which species is the reducing agent?

A. $Al(s)$
B. $Al^{3+}(aq)$
C. $Sn^{2+}(aq)$
D. $Sn^{4+}(aq)$

36. The net ionic equation for the reaction between aqueous solutions of tin(II) bromide and iron(III) nitrate is

A. $Sn^{2+}(aq) + NO_3^-(aq) \longrightarrow NO_2(g) + Sn^{4+}(aq)$

B. $Sn^{2+}(aq) + 2Fe^{3+}(aq) \longrightarrow Sn^{4+}(aq) + 2Fe^{2+}(aq)$

C. $2Sn^{2+}(aq) + Fe^{3+}(aq) \longrightarrow 2Sn^{3+}(aq) + Fe^{2+}(aq)$

D. $Sn^{2+}(aq) + 2NO_3^-(aq) \longrightarrow 2NO_2(g) + Sn^{4+}(aq)$

37. In the reaction $Cu(s) + 2Ag^+(aq) \longrightarrow Cu^{2+}(aq) + 2Ag(s)$,

A. $Cu(s)$ is reduced by the oxidizing agent
B. $Ag^+(aq)$ is the reducing agent and $Cu(s)$ is reduced
C. $Cu(s)$ is the reducing agent and $Ag^+(aq)$ is reduced
D. $Cu(s)$ is the oxidizing agent and $Ag^+(aq)$ is oxidized

38. Which compound of iodine has an oxidation number for iodine that differs from that of the other three compounds?

A. $H_4I_2O_9$
B. H_5IO_6
C. HIO_4
D. HIO_3

$$ClO_4^-(aq) \ + \ 8H^+(aq) \ + \ \underline{\quad}e^- \ \longrightarrow \ \tfrac{1}{2}Cl_2(g) \ + \ 4H_2O(l)$$
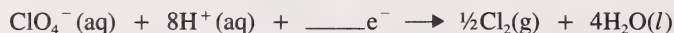
39. The number of electrons needed to balance the half-reaction is

A. 1
B. 4
C. 7
D. 8

$$\underline{\quad}O_2(g) \ + \ \underline{\quad}H^+(aq) \ + \ \underline{\quad}Ag(s) \ \longrightarrow \ \underline{\quad}Ag^+(aq) \ + \ \underline{\quad}H_2O(l)$$
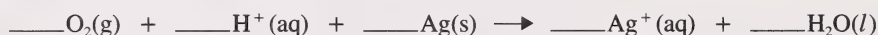
40. The coefficients for the balanced equation are

A. 1, 4, 4, 4, 2
B. 1, 4, 1, 1, 2
C. 1, 2, 1, 1, 1
D. 1, 1, 1, 1, 1

41. One half-reaction of a redox reaction can be expressed as
$Fe^{3+}(aq) \ + \ 3e^- \ \longrightarrow \ Fe(s)$. The reduction potential of this half-reaction is

A. $+0.77$ V
B. $+0.04$ V
C. -0.04 V
D. -0.77 V

42. Solutions containing $Fe^{2+}(aq)$, $Sn^{2+}(aq)$, and $Cr^{2+}(aq)$ are mixed together. The reaction most likely to occur is

A. $2Fe^{2+}(aq) \ + \ 2H_2O(l) \ \longrightarrow \ Fe(s) \ + \ O_2(g) \ + \ 4H^+(aq)$

B. $Sn^{2+}(aq) \ + \ 2Cr^{2+}(aq) \ \longrightarrow \ Sn(s) \ + \ 2Cr^{3+}(aq)$

C. $Sn^{2+}(aq) \ + \ Cr^{2+}(aq) \ \longrightarrow \ Sn^{4+}(aq) \ + \ Cr(s)$

D. $Sn^{2+}(aq) \ + \ 2Fe^{2+}(aq) \ \longrightarrow \ Sn(s) \ + \ 2Fe^{3+}(aq)$

Use the following information to answer question 43.

In an experiment, three strips of metal labelled X, Y, and Z were placed in 1.0 mol/L solutions of X^{2+}, Y^{2+}, and Z^{2+} ions. The results were tabulated:

Reagent	X^{2+}	Y^{2+}	Z^{2+}
X	N.R.	✓	✓
Y	N.R.	N.R.	✓
Z	N.R.	N.R.	N.R.

N.R. — no reaction
✓ — reaction occurs

43. Based on these results, the metals in order of decreasing ability to lose electrons are

A. X, Z, Y
B. Y, X, Z
C. Z, Y, X
D. X, Y, Z

Use the following information to answer question 44.

Four reducing agents listed in order of **decreasing** strength are W, Z, Y, and X.

Four statements about the reaction between the reducing agents and their respective oxidizing agents are:

I. $W(s) + X^{2+}(aq) \longrightarrow W^{2+}(aq) + X(s)$
II. $Y(s) + X^{2+}(aq) \longrightarrow Y^{2+}(aq) + X(s)$
III. $W(s) + Z^{2+}(aq) \longrightarrow$ no reaction
IV. $Y(s) + Z^{2+}(aq) \longrightarrow Y^{2+}(aq) + Z(s)$
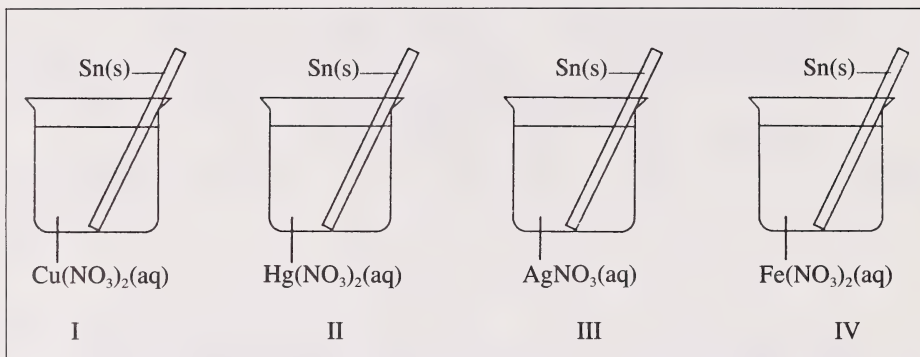
44. The statement(s) inconsistent with the correct order of reducing agents is(are)

A. IV only
B. III only
C. I and II
D. III and IV

45. The $E°_{net}$ of a gold-silver electrochemical cell, assuming standard state conditions, is

A. -2.22 V
B. $+0.62$ V
C. $+0.98$ V
D. $+2.22$ V

$Sn(s)$	$Sn(s)$	$Sn(s)$	$Sn(s)$
$Cu(NO_3)_2(aq)$	$Hg(NO_3)_2(aq)$	$AgNO_3(aq)$	$Fe(NO_3)_2(aq)$
I	II	III	IV

46. A spontaneous reaction will occur in all beakers **except**

   A. I
   B. II
   C. III
   D. IV

   _____

47. Which of the following occurs in an operating electrochemical cell?

   A. Chemical energy is converted to electrical energy.
   B. Electrical energy is converted to chemical energy.
   C. A nonspontaneous redox reaction occurs.
   D. Electrons flow from cathode to anode.

48. In electrochemical cells, the cathode is the electrode

   A. that releases electrons
   B. at which reduction occurs
   C. that most likely loses mass
   D. immersed in the reducing agent

49. Four cells containing $CuSO_4(aq)$, $AgNO_3(aq)$, $Pb(NO_3)_2(aq)$, and $Au(NO_3)_3(aq)$, respectively, are connected to power supplies that operate at 12.0 A for 1.00 h. At the end of this time, the cell that will deposit the greatest mass of metal is the

   A. $Pb(NO_3)_2(aq)$
   B. $Au(NO_3)_3(aq)$
   C. $CuSO_4(aq)$
   D. $AgNO_3(aq)$

YOU HAVE NOW COMPLETED THE MULTIPLE-CHOICE PART OF THE EXAMINATION. PROCEED DIRECTLY TO PART B.

PART B

INSTRUCTIONS

In this part of the examination, there are seven machine-scorable open-ended questions each with a value of one mark. All numbers used in the questions are to be considered as the result of a measurement.

Read each question carefully.

Solve each question and write your answer to three digits.

Record your answer on the answer sheet provided by writing it in the boxes of the corresponding answer field and by filling in the circles that match your answer. **Use an HB pencil only**.

Sample Question and Solution

Answer Sheet

1. The mass in grams of silver produced when 0.220 mol of silver nitrate reacts with excess copper to three digits is _____ g.

$$\text{mass}_{Ag} = 0.220 \text{ mol} \times 107.87 \text{ g/mol}$$

$$= 23.7314 \text{ g}$$

$$= 23.7 \text{ g (rounded to three digits)}$$

Record 23.7

If you wish to change an answer, erase your first answer completely.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

START PART B IMMEDIATELY.

An Energy Diagram for a Hypothetical Chemical Reaction
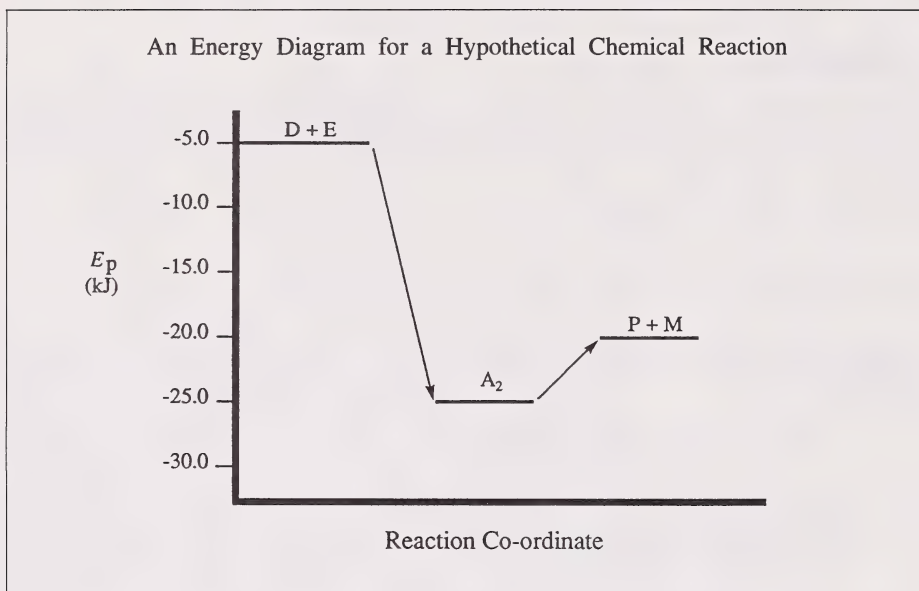
1. The heat released for the reaction D + E ⟶ P + M in kilojoules to three digits is _____ kJ.

2. In an experiment, 50.0 mL of $H_2SO_4(aq)$ are added to 150.0 mL of KOH(aq), and the temperature of the resulting solution increases by 4.00°C. Assume that the specific heat and the density of the system are the same as those of water. The heat produced by this reaction in kilojoules to three digits is _____ kJ.

3. Students should predict that the $[H_3O^+(aq)]$ of a fruit juice with a pH of 2.40 in millimoles per litre to three digits is _____ mmol/L.

Use the following information to answer question 4.

During a titration, results were recorded for three trials of the complete neutralization of 0.100 mol/L $Na_2CO_3(aq)$ with HCl(aq).

	Trial 1	Trial 2	Trial 3
Volume of $Na_2CO_3(aq)$	20.0 mL	20.0 mL	20.0 mL
Volume of HCl(aq)	22.5 mL	22.7 mL	22.6 mL

4. The minimum volume of this HCl(aq) required to completely neutralize 20.00 mL of 0.100 mol/L KOH(aq) in millilitres to three digits is _____ mL.

5. The minimum volume of 0.0250 mol/L $Ag^+(aq)$ necessary to react completely with 2.18 g of Zn(s) in litres to three digits is _____ L.

6. A student found that in an electrochemical cell utilizing lead metal and silver ions, the mass of lead that reacted was 2.40 g. The mass of silver metal that formed at the same time in grams to three digits was _____ g.

7. Under standard conditions, the net potential generated by the reaction of Cu(s) with acidified $MnO_4^-(aq)$ in volts to three digits is _____ V.

YOU HAVE NOW COMPLETED THE MACHINE-SCORABLE OPEN-ENDED PART OF THE EXAMINATION. PROCEED DIRECTLY TO PART C.

PART C

1. Explain why being burned by 25.0 g of steam at 100°C is more severe than being burned by 25.0 g of water at 100°C. Assume that both the steam and the hot water cool to 35°C. Include relevant calculations to support your response.

Use the following equation to answer question 2.

$$Fe(s) + Sn^{2+}(aq) \longrightarrow Fe^{2+}(aq) + Sn(s)$$

2. Assuming that the net ionic equation is for a functioning electrochemical cell containing 1.0 mol/L solutions,

(5 n

   a. write the redox half-reactions and their standard electrode potentials, and calculate the $E°_{net}$.

   b. the substance oxidized is _____ .

   c. the cathode substance is _____ .

   d. what would the voltmeter reading be when the cell reaches equilibrium? Why?

3. A student recorded the following data during the titration of a 10.0 mL sample of an unknown acid with a standardized 0.0250 mol/L solution of NaOH(aq):

Volume of base (mL)	pH	Volume of base (mL)	pH
2.0	5.50	20.0	10.00
8.0	6.00	22.0	11.00
12.0	6.50	30.0	11.90
14.0	7.00	32.0	12.00
16.4	8.00		

a. Carefully plot the data on the graph paper provided on page 23. Mark with a neat "X" the equivalence point on the graph.

Record the following information about the equivalence point:

pH _____ volume of base _____

b. What indicator could be used to determine the equivalence point?

c. From the titration curve, what conclusion can be drawn about the strength of the acid? Justify your answer.

YOU HAVE NOW COMPLETED THE EXAMINATION. IF YOU HAVE TIME, YOU MAY WISH TO GO BACK AND CHECK YOUR ANSWERS.

FOLD AND TEAR ALONG PERFORATION

NAME: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐

(LAST NAME)

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

(FIRST NAME)

DATE OF BIRTH: ☐☐ ☐☐ ☐☐

Y   M   D

SEX: ☐

PERMANENT MAILING ADDRESS: _____

(Apt./Street/Ave./P.O. Box)

(Village/Town/City)

(Postal Code)

SCHOOL CODE: ☐☐☐☐   SCHOOL: _____

SIGNATURE: _____